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A CONTRIBUTION TO THE LOCALIZATION OF
FOCAL LESIONS IN THE PONS-
OBLONGATA TRANSITION.

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THE following case not only illustrates the certainty with which limited lesions of the cerebral isthmus may be occasionally located, but also constitutes a contribution to the list of cases in which disturbances of associated eye-movements were observed during life, and brought into relation with special lesions after death :

Mary A., aged twenty-three, married, a factory operative, was kindly referred to me by Seneca Powell for examination on May 15, 1884, with the following history :

During the month of June, 1883, she had regularly every morning an attack of nausea or vomiting, or both, before going to her work. In July the vomiting ceased to be so regular, and occurred only in conjunction with the seizures which she experienced at this time. On three occasions, down to the month of September, she had an attack of mingled vertigo and a feeling, to use her expression, "as if going out of her mind"; this of such severity that she would keep her bed for from two to three days. It seemed, as she expressed it, "as though every thing in the room gyrated around her." In the third spell of this kind she

first noticed that her vision was blurred. She recovered from this as from the other spells entirely, returning to her occupation (that of a carpet-weaver) immediately after. Subsequently a numbness of the left side was noticed, but she continued at her work. It frequently became the subject of mirth among her fellow-operatives, that her mouth would suddenly become crooked—that is, drawn to the right—while at work. In November of the same year she had an attack of double vision, but is unable to say how long it lasted, further than that it was at most a few days. Recently she has not manifested distinct double vision, but complains of a dancing movement of objects. This subjective perverted perception is increased when she walks, and particularly when she attempts to look to the left, making her feel, as it were, “drunk.” The diplopia previously referred to was of such a character, that both images were on the same horizon; the dancing movement of objects, on the other hand, seemed to be chiefly in the vertical plane, though the patient is uncertain on this head.

About two months ago, March, 1884, her jaws became “tight”; it was impossible for her to separate the dental rows further than to admit a teaspoon between them. She felt this stiffness subjectively on the right side. Mastication was in consequence difficult, and continued impaired for some time after the spasmodic condition disappeared. For some months her voice has been noticed to have become nasal in character. There is commonly a subjective feeling of drowsiness, which is aggravated whenever her stomach is full.

The first permanent and continuous symptom was difficulty in swallowing. It began about the time of the seizure in September. At its onset it was extreme, and on more than one occasion threatened a fatal result, the saliva accumulating in her mouth during the night causing her to choke and wake up. Sometimes she would experience as many as from forty to sixty distressing spells of choking and strangling in one day. The attacks have become fewer but of greater severity. At first fluid food was more difficult for her to manage, but she can drink now under certain precautions, while dry

food, which gave her no distress at the start, does so now. She occasionally had a sensation as if something in the head pulled it back, at other times her heart gives a sudden violent thump, and the patient asserts that it has "held over"—that is, stopped—for as many as two or three beats. These evidences of disturbed cardiac action were most marked in March, 1884. Then and now she has attacks of anxiety associated with shortness of breath, which are aggravated or provoked when she drinks or eats.

The hemi-numbness has continued increasing during the last six months, and a sensation of pins and needles is often noticed in the left extremities. The left leg sometimes drags, the toe has never turned under, nor have her ankle or knee ever given way. For some time, whenever she touched her left leg or arm, a "funny" sensation resulted, this later was compared to a cold sensation, and remained limited to the spot touched. She frequently has a spontaneous cold sensation on the left side of the body, in warm weather, and when the right side enjoys the normal appreciation of the outside temperature. The numb sensation in the left arm becomes aggravated into a pin-and-needle and going-to-sleep feeling, if it is allowed to rest long in one position. To some extent, she claims to be able to overcome this, using her expression, "by rubbing life into it."

She had a buzzing noise in her right ear two weeks ago, and has it now and then at intervals in varying intensity. It has not been recollected whether any such sensation accompanied her vertiginous seizures.

The functions of the stomach have been more or less disordered; at present she is able to retain her food, but is compelled to remain perfectly still, or else she would vomit it. She finds difficulty in eructation of the stomach gases, which form in considerable quantity.

The patient is a well-nourished, rather good-looking woman of robust build. She has been married three years and seven months. Shortly after marriage, when pregnant about three months, four sores appeared on her labia. These were a little larger than the conventional cent; they opened under local treatment, and, according to the account, dis-

charged matter and blood. The child was born in the seventh month of gestation and died four days after birth. Since its delivery the mother has suffered from metrorrhagia, and during the year past from what was pronounced uterine catarrh. Her hair fell out to a remarkable extent after the child's birth. She speaks of a white patch in her throat, which was treated shortly after marriage, and to which she called Doctor Powell's attention. I was unable to find any certain traces of past throat trouble. Aside from pityriasis versicolor, a cicatrix over the left breast from mammary abscess, and gastro-intestinal disturbances, the patient presents no other anomaly in her present condition or her history than those mentioned, aside from the symptoms of axial cerebral disease now to be detailed.

Locomotion.—There is no anomaly observable in walking, in turning, in standing, or walking with the eyes closed, in standing on either foot with the eyes open. She is nearly as well able to stand on the left leg, with the eyes closed, as on the right. It must be remembered that many normal persons with pronounced dextral preference show the same difference.

Muscular power.—Repeated crude trials show no perceptible difference in the muscular powers of the lower extremities. A stiff dynamometer shows for the right grasp sixty, for the left grasp fifty. The individual motions show no indications of enfeeblement. The patient is dextral.

Muscular sense.—The patient is not uncertain about the position of the segments of her arm and leg; as to degree of flexion or extension, she is not always able to place her left upper and lower extremities in position symmetrical with a passively given position of the corresponding right limb, when her eyes are closed. She is able to touch a given part of her body correctly and quickly with the left index finger.

Cutaneous space-sense.—Repeated trials fail to show any difference in the ability to appreciate the points of the æsthesiometer. Generally the patient's space sensibility is rather under the figures assigned by physiologists. To this I can attach no importance, as those figures are far too

high—at least for certain classes of the human family. The patient localizes well, but is unable to distinguish the nature of objects and various degrees of roughness, as well with the tips of the left fingers as with the right, tested with files and rasps.

Temperature-sense.—Repeated tests failed to reveal any difference between the two sides. She can tell whether the object touching her be warm or cold, but contact of both warm and cold objects produces an ice-cold after-sensation.

Cutaneous pressure-sense.—The patient does not appreciate five-fold weight differences with the left side that she is able to appreciate with the right. She can feel the addition of a penny to a silver dollar in the right palm, and the addition of a dollar to a dollar with the left, but not of a quarter nor always of a half dollar. The same difference is noted with the foot; the microtome cylinders being used, she is able on the dorsum of the left foot to detect the addition of the intermediate size, but not of the smallest and lightest, which she does notice with the right. The patient has herself noticed that she does not feel a grip of the hand nor the pressure of a shoe as well on the left as on the right side.

Pain sense is normal.

General cutaneous sensations. Touching any part of the left leg or arm, which six months ago produced what she calls a "funny sensation," now produces a cold feeling, limited to the part touched—as previously stated—even if the subject be warm. A stroke of the hand down either limb, but most marked with the leg, produces a cold streak, as if a stream of ice-cold water were running down the limb. Her left side feels cold at times, when the other side feels properly warm in warm weather.

Reflexes. The tendon and abdominal reflexes are symmetrical and normal; the tickling reflexes are all exaggerated, notably the solar.

Facial nerve.—There is total paralysis of every external branch of the right nerve; the right side of the face is blank, and no voluntary or reflex movement is possible; there is consequent lagophthalmus; the uvula, however,

deviates to the right; there is excessive lachrymation of the right eye, which it is impossible to close.

There was a slight increase in both faradic and galvanic excitability, but no change of the formula; the muscular contractions appeared retarded. This was found to apply to all the external branches of the nerve. There occurred no further opportunity of repeating and extending these tests, owing to the failure of the patient to report to me in person. The patient and her sister state that the left side was more drawn (antagonistic contracture) a few weeks ago than it is now.

Hypoglossal nerve.—The tongue, as a whole, deviates to the right, while its axis is curvilinear, the point tending to the left; there are no twitchings nor tremors.

Gustatory function.—The patient can detect the bitterness of quinine, the sweetness of a syrup, and the flavor of assa-fœtida on both sides, but with greater slowness and hesitation on the right side.

Vocal cords.—No paralysis of the cords; both movements of phonation and respiration normal.

Fifth pair.—The patient feels subjective numbness on the right side of the face, and limits it accurately to the right of the median line; it does not extend to the hairy scalp. There is no objective difference of the cutaneous space-temperature- or pain-sense on the face or tongue.

The palate is relaxed, and the patient, in swallowing water, evidently resorts to a manœuvre which one of my patients with glosso-labio-laryngeal paralysis calls "resting on the swallow." The stomach is distended with gas, and the patient, in trying to eructate, finds it impossible to raise the wind, as she calls it, above the level of the sternum, borborygmi can be heard to rise to that level. The heart-sounds are normal, the auscultation being continued for ten minutes; an unusually loud systolic sound was heard, accompanied by a visibly stronger apex impulse, and followed, after a pause equivalent to three quarters of a beat, by a number of rapid, indistinct pulsations which gradually passed into the normal. A second sensation, like that accompanying this episode, had been previously experienced

by the patient while in the office, the whole time being an hour and a half. The sphygmographic tracing was typical; tension moderate; no tracing was obtained of the phenomenon. I have lost it. The urine had been examined by Dr. Powell and found normal. I never obtained a specimen. No abnormality in micturition nor thirst.

The *optic nerve* is normal, the color sense perfect; there is no limitation of the visual field. There is no ascertainable diplopia while the patient looks directly forward or to the left.

Pupils equally and regularly four mm. under moderate illumination, react to light not very actively, contract under accommodation to pinhole dimensions, and remain in pinhole contraction after accommodation and convergence are suspended. They then return slowly to the previous condition, fully a half minute being thus occupied.

Binocular movements.—The patient is able to move both eyes together freely upward, downward, and to the left; the attempt to move either eye to the right of the middle of the palpebral fissure fails, both eyes being arrested as by an obstacle. At the time I had not read Hunnius' excellent monograph, but I recorded in my notes: "It is as if a wall were built up against the eyes at this point." Hunnius used the expression, "*festgemauert*" for his case three years previously. There is nystagmic oscillation with extreme movement to the left, and the dancing movement of objects previously referred to is then complained of. The patient does not localize the direction of this dancing movement.

Monocular movements.—The left eye separately examined shows no nystagmus, and can be moved in all directions; the right eye cannot be moved to the right beyond the middle of the palpebral fissure; at the extreme point it shows slight lateral oscillation; its other movements are unhindered.

When the patient is told to close the eyes, the right eye, which is left uncovered by the lid, is seen to roll upward in the normal way.

Lateral movement of the jaw is free in both directions;

the masseters both contract when the teeth are pressed together, less firmly it seems on the right side.

The diagnosis was made a focal affection: neoplasm, probably a syphiloma, in the level of the pons-oblongata transition, situated in the right reticular field of the tegmentum, involving either the facial nucleus or root—probably both—and the roots of the abducens nerves, as well as the nuclei of the pneumogastric. Mixed treatment, which Dr. Powell had previously given, ordered continued.

I heard from the patient by messenger on several occasions. She at times complained of severe occipital headache on the right side, but not to the same extent as some months previously. Doctor Powell informed me verbally that cauterization of the nuchal region relieved this. She developed a ravenous appetite, which nothing could satisfy, and this bulimia continued down to within eight days of her death, when it gave way to as pronounced an anorexia, as it happened, fortunately, for deglutition was scarcely possible.

On July 7th I saw her at her home, in company with the physicians whom I had invited to attend the autopsy, in the event of its being permitted. The patient had not slept the preceding night, sudden shocks of the lower part of her body startling her as she dozed. The eye-symptoms have remained stationary, except in so far as the nystagmus is concerned, which is only occasionally noticed, and with extreme innervation. The head when raised shows an oscillatory motion, and there is a tendency to sinistral rotation, but of a passive character. No conjugate deviation has ever been noted, nor is there any trace of it now; the right abducens muscle is more decidedly paretic in monocular as well as binocular action; the globe being turned towards the inner canthus, this position can be partly overcome under binocular innervation. The upward movement of the right eye in closing is retained.

The tongue, which is angry-looking and heavily coated, deviates as a whole to the left; its right half is much more voluminous in all dimensions than the left; it is not protruded readily, and shows fibrillary tremor. The cardiac impulses previously described are still noticed, and accom-

panied the shocks complained of last night; the dyspnœa is increased, though there is no pulmonary trouble. The right arm measures six and a half and the left six inches, in circumference. There is now distinct ataxia of movement, marked inability to assume symmetrical positions, to touch the nose with the tip of the finger while the eyes are closed, except after repeated error and explorations, while the cutaneous space- and pain-sense are normal. The patient has for the past few days micturated frequently, and large quantities of light-colored urine. No specimen could be obtained—and it was forgotten in the anxiety to secure the autopsy to order the preservation of any.

The patient being evidently approaching a moribund state, this condition precludes a lengthy examination. She can stand, but has not ventured to walk across the floor for a week, feeling uncertain as to her left lower extremity. She has noticed this uncertainty for some days before taking to her bed. She complains of a sense of heat on the right side of the face and head and a pulsating sensation in the right occipital region.

She menstruated last week, being two weeks over time. The blood was noted to be unusually dark. The pulse is feeble, variably irregular, and often intermittent.

The speech is indistinct; an undoubted anarthric element is added to the effects of palatine paralysis. In her position and situation the palate could not be distinctly examined.

Diagnosis previously made adhered to, with the modification: extension of neoplasm to hypoglossal nuclei and right interolivary layers.

The subsequent history was obtained after death.

July 8th she experienced excruciating pain in the right side of her head, sharpest in the occipital region, but extending over the entire half of the cranial region. She was beside herself with agony, crying out: "My brain! my brain!" Her sister was the only person who could understand her. Speech became so indistinct, however, that even she was unable to distinguish any thing beyond monosyllables for the twelve hours preceding death. The patient attempted to, but could not, enunciate. For one hour pre-

ceding death the pain ceased. The patient was thoroughly conscious to the last moment,—signing for water and other objects desired; was able to pass the glass to her mouth, even with the left hand, though with some uncertainty, but unable to say a word: shaking her head when asked to speak, and answering questions correctly by nods or shakes. She was also unable to swallow.

Ten minutes before death she had a chill-like convulsion of the entire body, without loss of consciousness. The night before her death the bodily surface, which had previously been cool, became hot, and remained so, till the last moment. She was noticed to choke and gurgle a great deal, to use the words of her attendants.

It had been repeatedly stated by the patient during the period of bulimia, that she did not taste the food on one side of her mouth, and eight days before death, when eating a piece of pie, she said: "Now that is funny. I can not taste this at all, any more than if it were paper." It was unfortunately neglected to test the sense of taste on the occasion of my last visit. The cold sensation had been felt in both lower limbs and the left arm, for several days before death.

The patient died a little after six o'clock on the 9th of July.

The autopsy was made, in the presence of Doctors Brill, Mollenhauer, F. A. McGuire, Barry, Harwood, and Adrian, at one o'clock the same day; only the cranial cavity was allowed to be opened, but the upper part of the spinal cord, down to the middle of the cervical enlargement, was removed as well.

The body appeared fairly well nourished; the difference between the arms noticed during life had not changed. There was a little rigor mortis; the pupils in median contraction. There is an irregular linear cicatrix on the under part of the left breast, and some spots of pityriasis versicolor are visible on the back and shoulders.

The posterior segment of the skull was removed, so as to show the basilar structures in their natural relations, and I had the gratification of anticipating a confirmation of the diagnosis made, before the occipital cap had been raised. The cervical vertebral arches having been removed, and the

membrana obturatoria dissected away, a distinct bulging of the right side of the anterior part of the oblongata, in the region of the clava and restiform body could be seen.

I would strongly recommend this method of removing the brain employed in all cases of suspected basilar or axial disease. By the ordinary method it would have been impossible to determine one point, of great pathological importance in this case, namely, the possible occurrence of pressure on other parts of the brain, or on the nerve roots. I was able to exclude this factor; the tumor was visible as soon as the bony shell was slightly raised, before it was even entirely removed, and nowhere crowded any part of the cerebellum or other neighboring parts. The choroid plexus, however, was greatly flattened; this appeared to be as much due to its widening out as to pressure, and the same explanation is to be offered for the thinning and dehiscence of the velum medullare, which was normal in texture.

The bony structures were healthy; the dura, which was intrinsically normal, appeared to be more firmly adherent than usual; the pia was healthy; and with the exceptions to be detailed the cerebral tissues showed nothing abnormal.

The floor of the fourth ventricle in this district showed the following abnormalities:

The contour of the posterior angle was rounded, and the sides thrust asunder, so that the *alæ cineræ* were crowded from their usual situation far ectad; they were unusually pronounced, the right indeed quite black, the left nearly as dark. The furrow which under normal circumstances diagonally subdivides these *alæ* was obliterated.

The inner two thirds of the posterior fovea, including the region of the *striae medullares*, and extending over the eminentia faciales, in front, and encroaching on a narrow rim of the left side, was of a gelatinous gray color, marked here and there by a beautifully clean purplish shade. The only normal structures that could be identified in this mass were the stria. These ran in their usual distinctness and whiteness nearly to the middle line. There was considerable injection, the vessels appearing like blackish and purplish streaks in many places. The focus of the neo-

plasm had an appearance as if composed of an agglomerated mass of spheres, like boiled sago, an appearance which became more distinct during the first days of bichromate of potash hardening. Some epithelial granulations were scattered over the middle third of the ventricle and over the right ala alba medialis.

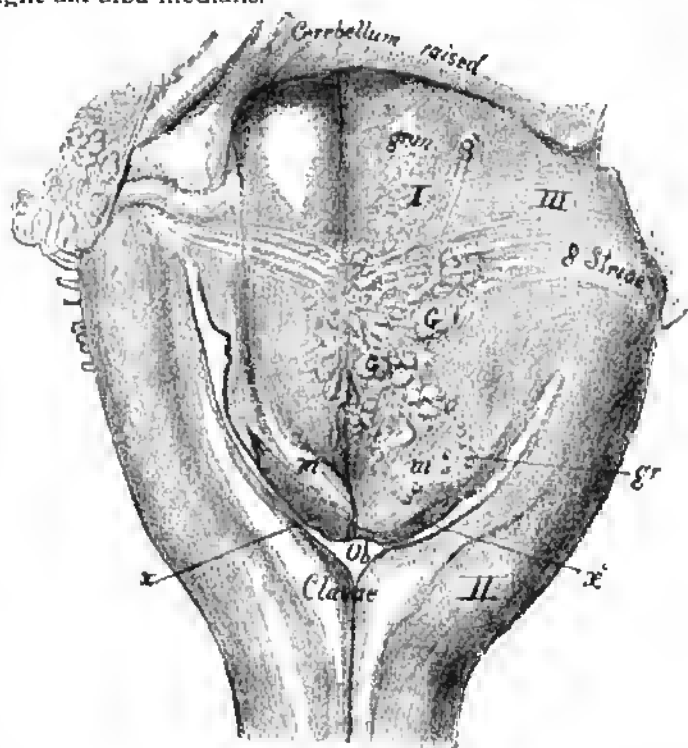


Fig. 1.

Dorsal face of pons-oblongata transition of Mary A—, magnified two diameters, and drawn from the fresh specimen. I., II., and III. indicate the inflated region, the cerebellum is raised. Ob, obex; *mi, m'*, *ala alba medialis*, crowded asunder by *G*; *G, G'* translucent region extending along ventricular sulcus; *S Striae*, *striae medullares albae*; *g'*, so-called "Klangstab" (*scala rhythmica* of Bergmann); *gr* endymal granulations in posterior angle of ventricle; *grun*, same near anterior angle; *x, x'*, *ala cinerea*, crowded aside.

A section made through the upper sixth of the oblongata showed that the abnormal side was greatly hypertrophied, and that in consequence the contour lines were less sharp than in the normal condition. At the same time the more healthy side had also been distorted, chiefly because the

raphe portion had degenerated in obedience to the distending influence of the tumor.

As this was the only level where the topography of the lesion was observed while in the fresh state, its description may be here given. The section included both glossopharyngeal and subdymal vagi nuclei, the so-called nucleus of the fasciculus teres and the upper part of the hypoglossal nuclei, the restiform columns, the ascending trigeminal nerve roots, the olives, interolivary layers, pyramids, and the trans-section of the solitary bundle.

The lesion was distinctly marked by the translucent nature and gray-blue tint of its area, which while it passed gradually into the normal texture, did so within a very narrow zone, not exceeding a millimetre in width. The focus of the lesion was at the ventricular floor, at the vagus nucleus and trincural fasciculus, and extended from here deeply into the reticular formation, becoming lost before the olive was reached; the ascending root of the fifth pair and the restiform column showed their normal whiteness. The lesion extended across the median line at the ventricular floor for four millimetres, and along the left side of the raphe for the same extent: on the right side it extended down as far as the interolivary layer, including its upper half. There was a spot of softening, in the ectal half of the interolivary stratum, of the diameter of three millimetres, situated in what subsequent examination showed to have been the peripheral zone of infiltration.

The consistency of the morbid infiltration was slightly less than that of fresh nervous substance, but more elastic. It was nowhere diffuent in this level, except in so far as the spot just mentioned may be so regarded. Indeed, it maintained its consistency so well during the first stages of the hardening process, which was conducted in ice-surrounded vessels, that it was hoped nothing would interfere with the obtaining of a complete and regular set of sections. This hope was deceived; the neoplasm hardened so differently from the rest of the specimen that after-treatment with glycerin, involving all the disadvantages attending that method, became necessary.

(To be continued.)